

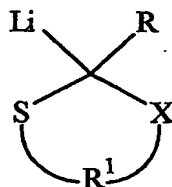
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CLAIMS

What is claimed is:

1. An sulfur containing anionic polymerization initiator that is defined by the formula

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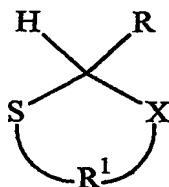
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where R is selected from C₁ to C₆ trialkyl-silyl groups, C₁ to C₂₀ alkyl groups, C₄ to C₂₀ cycloalkyl groups, C₆ to C₂₀ aryl groups, thienyl, furyl, and pyridyl groups; and R may optionally have attached thereto any of following functional groups: C₁ to C₁₀ alkyl groups, C₆ to C₂₀ aryl groups, C₂ to C₁₀ alkenyl groups, C₃ to C₁₀ non-terminal alkynyl groups, ethers, *tert*-amines, oxazolines, thiazolines, phosphines, sulfides, silyls, and mixtures thereof; where R¹ is selected from C₂ to C₈ alkylene groups and where X is selected from S, O and NR and wherein R is as defined above, and may optionally have attached thereto any of the above identified functional groups.

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2. A method for preparing an anionic polymerization initiator comprising the step of reacting a sulfur-containing initiator precursor with an organometallic compound, wherein the precursor is defined by the following formula:

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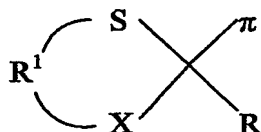


where R is selected from C₁ to C₆ trialkyl-silyl groups, C₁ to C₂₀ alkyl groups, C₄ to C₂₀ cycloalkyl groups, C₆ to C₂₀ aryl groups, thienyl, furyl, and pyridyl

5 groups; and R may optionally have attached thereto any of following functional groups: C₁ to C₁₀ alkyl groups, C₆ to C₂₀ aryl groups, C₂ to C₁₀ alkenyl groups, C₃ to C₁₀ non-terminal alkynyl groups, ethers, *tert*-amines, oxazolines, thiazolines, phosphines, sulfides, silyls, and mixtures thereof; where R¹ is selected from C₂ to C₈ alkylene groups, where X is selected from
 10 S, O and NR and wherein R is as defined above, and may optionally have attached thereto any of the above identified functional groups.

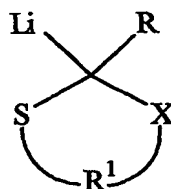
3. A functional polymer that is defined by the following formula

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where R is selected from C₁ to C₆ trialkyl-silyl groups, C₁ to C₂₀ alkyl groups, C₄ to C₂₀ cycloalkyl groups, C₆ to C₂₀ aryl groups, thienyl, furyl, and pyridyl
 20 groups; and R may optionally have attached thereto any of following functional groups: C₁ to C₁₀ alkyl groups, C₆ to C₂₀ aryl groups, C₂ to C₁₀ alkenyl groups, C₃ to C₁₀ non-terminal alkynyl groups, ethers, *tert*-amines, oxazolines, thiazolines, phosphines, sulfides, silyls, and mixtures thereof; where R¹ is selected from C₂ to C₈ alkylene groups, where X is selected from
 25 S, O and NR, where R is as defined above, and may optionally have attached thereto any of the above identified functional groups and where π is a polymer chain.

30 4. A method for preparing a functional polymer, the method comprising:
 initiating a living polymer chain with a sulfur containing initiator,
 where the initiator is defined by the formula



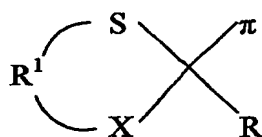
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where R is selected from C₁ to C₆ trialkyl-silyl groups, C₁ to C₂₀ alkyl groups, C₄ to C₂₀ cycloalkyl groups, C₆ to C₂₀ aryl groups, thienyl, furyl, and pyridyl groups; and R may optionally have attached thereto any of following functional groups: C₁ to C₁₀ alkyl groups, C₆ to C₂₀ aryl groups, C₂ to C₁₀ alkenyl groups, C₃ to C₁₀ alkynyl groups, ethers, tert-amines, oxazolines, thiazolines, phosphines, sulfides, silyls, and mixtures thereof; where R¹ is selected from C₂ to C₈ alkylene groups, where X is selected from S, O and NR and wherein R is as defined above, and may optionally have attached thereto any of the above identified functional groups.

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5. A vulcanized rubber composition comprising at least one vulcanizable rubber and a filler, where the at least one vulcanizable rubber is a functional polymer that is defined by the formula

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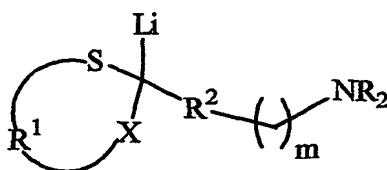


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where R is selected from C₁ to C₆ trialkyl-silyl groups, C₁ to C₂₀ alkyl groups, C₄ to C₂₀ cycloalkyl groups, C₆ to C₂₀ aryl groups, thienyl, furyl, and pyridyl groups; and R may optionally have attached thereto any of following functional groups: C₁ to C₁₀ alkyl groups, C₆ to C₂₀ aryl groups, C₂ to C₁₀ alkenyl groups, C₃ to C₁₀ non-terminal alkynyl groups, ethers, tert-amines, oxazolines, thiazolines, phosphines, sulfides, silyls, and mixtures thereof; where R¹ is selected from C₂ to C₈ alkylene groups, where X is selected from S, O and NR where R is as defined above, and may optionally have attached

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- 5 thereto any of the above identified functional groups, and where π is a polymer chain.
6. The composition of claim 5 wherein the filler comprises carbon black, silica, starch, aluminum hydroxide, magnesium hydroxide, clays (hydrated aluminum silicates), and mixtures thereof.
- 10 7. A tire component comprising the rubber composition of claims 5 or 6.
8. The initiator of claim 1, further defined by the following formula:



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where R^2 is selected from the group consisting of C_1 to C_8 alkylene groups, C_3 to C_{12} cycloalkylene groups and C_6 to C_{18} arylene groups and m is 0 to about 8.

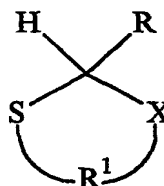
- 20 9. The initiator of claims 1 or 8, or the method of claims 2 or 4, wherein the initiator is selected from 2-lithio-2-methyl-1,3-dithiane, 2-lithio-2-phenyl-1,3-dithiane, 2-lithio-2-(4-dimethylamino)phenyl-1,3-dithiane, 2-lithio-2-trimethylsilyl-1,3-dithiane and 2-lithio-2-phenyl-1,3-oxathiane.
- 25 10. The method of claim 4 wherein the living polymer chain is selected from conjugated dienes having from about 4 to about 12 carbon atoms and monovinyl aromatic monomers having 8 to 18 carbon atoms and trienes and mixtures thereof.
- 30 11. The method of claim 4 further comprising the steps of:
providing a reaction medium;

5 adding a monomer or monomers to be polymerized to said reaction medium; and
 adding the initiator to said reaction medium.

12. The methods of claims 4, 10 or 11, further comprising the step of:
 10 terminating the living polymer chain with a terminating agent, coupling agent, or linking agent.

13. A method for anionically polymerizing monomers comprising the steps of:
 synthesizing a sulfur containing anionic initiator in the presence of
 15 monomer from a precursor and an organolithium compound;
 polymerizing said monomers with said sulfur containing anionic initiator to provide a functional head group on the polymer.

14. The method of claim 13, wherein said precursor is selected from sulfur
 20 containing lithio compounds having the general formula

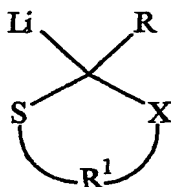


25 where R is selected from C₁ to C₆ trialkyl-silyl groups, C₁ to C₂₀ alkyl groups, C₄ to C₂₀ cycloalkyl groups, C₆ to C₂₀ aryl groups, thienyl, furyl, and pyridyl groups; and R may optionally have attached thereto any of following functional groups: C₁ to C₁₀ alkyl groups, C₆ to C₂₀ aryl groups, C₂ to C₁₀ alkenyl groups, C₃ to C₁₀ non-terminal alkynyl groups, ethers, *tert*-amines, oxazolines, thiazolines, phosphines, sulfides, silyls, and mixtures thereof;
 where R¹ is selected from the group consisting of C₂ to C₈ alkylene groups and
 30 where X is selected from the group consisting of S, O and NR, wherein R is as defined above, and may optionally have attached thereto any of the above identified functional groups.

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15. A method for anionically polymerizing monomers comprising the step of:
polymerizing said monomers with a sulfur containing anionic initiator
to provide a functional head group on the polymer.

- 10 16. The method of claim 15, wherein said sulfur containing anionic initiator is
selected from the group consisting of sulfur containing lithio compounds
having the general formula



- 15 where R is selected from C₁ to C₆ trialkyl-silyl groups, C₁ to C₂₀ alkyl groups,
C₄ to C₂₀ cycloalkyl groups, C₆ to C₂₀ aryl groups, thienyl, furyl, and pyridyl
groups; and R may optionally have attached thereto any of following
functional groups: C₁ to C₁₀ alkyl groups, C₆ to C₂₀ aryl groups, C₂ to C₁₀
alkenyl groups, C₃ to C₁₀ non-terminal alkynyl groups, ethers, tert-amines,
20 oxazolines, thiazolines, phosphines, sulfides, silyls, and mixtures thereof;
where R¹ is selected from C₂ to C₈ alkylene groups, where X is selected from
S, O and NR, where R is as defined above, and may optionally have attached
thereto any of the above identified functional groups.

- 25 17. The functional polymer resulting from the method of claims 15 or 16.